# Sample dependent weighting functions and neutron sensitivity corrections for $C_6D_6$ detectors by Monte Carlo simulations

Aerts[1], Gunsing[1], Borella[2], Schillebeeckx[2]

[1] *CEA Saclay*
[2] *Institute for Reference Materials and Measurements*

To determine capture cross sections using $C_6D_6$ detectors, the Pulse Height Weighting Technique (PHWT) is mostly applied. Therefore, the quality of the data depends strongly on the detector response used for the calculation of the weighting function. In addition, for nuclei with small capture-to-scattering ratios (light and neutron magic nuclei) reliable capture cross section can only be obtained after a correction for the neutron sensitivity of the detector. An experimental determination of both the response and neutron sensitivity of $C_6D_6$ detectors is not always straightforward. We determined these quantities from Monte Carlo simulations, using the MCNP 4C3 code. To obtain reliable results a big effort was made in preparing a geometry input file describing the experimental conditions. To validate the results of the Monte Carlo simulations we performed several experiments at GELINA. We determined the neutron width of the 1.15 keV resonance in $^{56}$Fe using different sample compositions; we measured the $C_6D_6$ detector response for selected resonances in the $^{206}$Pb(n,$\gamma$) and for neutron scattering on $^{208}$Pb and on a carbon scatterer. The good agreement between experimental and simulated data confirms the reliability of the Monte Carlo simulations. Monte Carlo simulations can be used to determine weighting functions, which also account for the photon transport in the sample. Such weighting functions are required for capture reactions in nuclei where the gamma cascade differs strongly from resonance to resonance, and are extremely important for neutron data related to reactor technologies where Pb-isotopes play an important role.

Email: peter.schillebeeckx@cec.eu.int